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Proposal - Developing A Practical Implementable Example Management Architecture for the Smart Grid

Prepared for: Smart Grid Interoperability Panel

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Proposal - Developing A Practical, Implementable Example Management Architecture for the Smart Grid

Introduction and Background

Development of an effective management system requires an integrated view of all facets of the environment it is to manage. In the case of the Smart Grid, elements include: protocols, media, applications, managed devices and other physical elements, services, security, users, external interfaces, and other key elements. Without this integrated view, and a clear understanding of the full set of requirements it must meet; engineering an architecture/solution is likely to suffer high-cost, poor performance and an inability to meet user expectations. Additionally, if the management system is not designed concurrently with the rest of the environment, it may not be possible to retrofit the environment at a future date to address management which will raise the cost of the system and overall cost of grid operation.

To this point, the Smart Grid Interoperability Panel has been working on a number of key issues such as general architecture, several information/data models for a number of domains, and security architecture. These activities come from a number of standards development organizations and industry groups all provide key input to a management system, however; a comprehensive review of these inputs and others that have yet to be defined such as the scope and requirements of a Smart Grid Management System (SGMS) has not taken place. Equally important would be a review of the interrelationship these inputs have one one another from the perspective of the management system. This raises the risk and cost of SGMS work in the future and potentially means that the rest of the system may not be as effectively and efficiently managed.

After raising these concerns, I was asked to present to the September 15, 2010 Priority Action Plan (PAP) 1 meeting in St. Louis by David Su, NIST Technical Lead for PAP01[1] in the Smart Grid Interoperability Panel. During that presentation, I made 4 key points:

1. Network Management spans many areas and needs to have a broad view in order for an effective management architecture to be developed.
2. There is no activity at present in the SGIP to broadly address the network management area, Additionally there is no known plan/roadmap for achieving this goal.
3. The end-result of any activities designed to address this gap would ideally be: a practical, implementable, example management architecture for the Smart Grid. For this architecture to be something that has direct use for the stakeholder community, it must have sufficient specificity so that the offered technologies by the SDO's and requirements from a variety of communities can be evaluated to identify gaps, key relationships, inconsistencies or inefficiencies that will adversely impact the management system. It is not intended that the example architecture be the only architecture. It is simply one possible example that stakeholders could use to move forward with additional architecture, design and development work.
4. We should develop and follow a plan that will result in the desired architecture that includes, but is not limited to: A background white paper that describes the need and background for the work (this paper or possible future revisions), a complete requirements analysis from all stakeholders, evaluation of all the inputs from the

[1] PAP01 - Role of IP in the Smart Grid.

various SDO's and industry groups, gap analysis, feedback to the SDOs (probably this will be iterative), and development of the example architecture.

Proposed Work Plan

While the presentation in this document suggests a sequential process, it is likely that several activities will proceed concurrently assuming resources to do the tasks. It is also the case that this process will also be iterative for some time as the technologies and requirements mature.

Scope Identification

An early element of work will the identification of the scope of the management system required. That is; does the system support third party Smart Grid service providers, Utilities, Users, etc? For each of these groups individual requirements will have to be collected. In short, this will identify the stakeholders in the Smart Grid Management Software ecosystem.

Requirements Collection

Some good work has been done with use cases and some management technology requirements. All these should be collected together and integrated. Each of the stakeholders will be asked for input and to comment on requirements by other stakeholder categories since a requirement in one area is likely to have an impact on other stakeholders or supplied technologies.

Collection of Input Technologies

Many of the PAPs represent one or more technologies that include elements from which we would build the management architecture or which would impact the design of the management system. A key example of this are the object models for different domains in the Smart Grid. These items become a core element of the software architecture and design. The work in the Architecture and Security areas are also key inputs. To a great degree, much of the security will be managed by the system as it will be responsible for the configuration of elements in the Smart Grid.

Analysis of Base Technologies and Inputs

Once we have the various inputs of technologies that are elements of the Smart Grid that require management and at least some of the building blocks that influence the management system, such as management protocols, we can analyze if there are gaps or unintended negative impacts to the management system.

Cross Technology Issues Identification

A key goal of the work will be to identify the interaction of the various technologies the system will use and aspects of the Smart Grid to be managed. For example, however well information models are defined and coordinated on a bi-lateral basis, the management system must operate on all the models defined to be in scope as an integrated whole. Issues may emerge that will require adjustment in several of the models or other technologies supplied by SDO's.

Feedback To SDO's and other Stakeholders

After the evaluations are completed, we the group will provide feedback to all the SDOs with requests for adjustments if necessary. This process is likely to require several passes.

Reference Architecture Definition

Once the above tasks are complete, or at least on the way to completion, an architecture for the management system can be developed that shows specific models, protocols, security methods, use cases can be developed. The purpose of such an effort is to provide an example to interested stakeholders on how key building blocks could be put together to develop a management system.

Ongoing Architectural Maintenance and Documentation

Since the Smart Grid is a new concept and many of the technologies will necessarily change in the short and mid-term, it is reasonable to expect that some of these changes will also impact management requirements. As a result, ongoing 'maintenance' will be needed for some time.

Suggested Group Structure

There was some discussion of how a group could be formed that would be able to accomplish the tasks outlined in this paper. David Su agreed at the PAP01 meeting to take these matters up with NIST and other key SGIP members to propose a way forward.

After looking at the scope of the work, it appears as if there is a strong correlation in type of work to be done in the management area as is currently underway in the Cyber Security Working Group. An architecture is being developed, requirements are being evaluated and many other activities that are similar in nature those proposed here are under way. Such an approach represents the broad scope and importance of the work to be done.